Terry

HAWAII ENVIRONMENTAL SIMULATION LABORATORY

March 22, 1973
TM73-016

MEMORANDUM

TO: Ms. Lucy Naluai, Chairman
Hui Malama Aina O'Koolau

FROM: Hawaii Environmental Simulation Laboratory

SUBJECT: Request to Review the Kahaluu Flood Control Project

This document includes a review and a summary of the Kahaluu Flood Control Project which Hui Malama asked HESL to prepare. HESL hopes that it will be useful to the Hui and other interested persons and agencies involved in Planning for the Kaneohe Bay region.

252—A Spalding Hall • 2540 Maile Way • Honolulu, Hawaii 96822 • Phone (808) 948-7372 or 948-7373

SUMMARY

Major points raised by HESL's preliminary review of the flood control project:

1. A wider range of structural alternatives could be considered.

2. Estimates of costs and benefits due to the project may be misleading because of exclusions or conditions which have changed since the initial analysis.

3. A decision on the flood control project is dependent on the decision as to the nature of Kahaluu's future. Deciding on the flood control project without deciding on the future of Kahaluu will decrease the choices for Kahaluu.

4. The question of who benefits and who is hurt by the project is as important as the size of the net benefit from the project.

5. The question of the overall effect on the marine environment needs to be more fully explored. It is not clear that the project will either improve water quality or reduce damage to Kaneohe Bay, especially when the impact on urbanization is considered.

6. The appropriateness of the Soil Conservation Service promoting a project whose primary impact will be to reduce the level of agricultural activity in Kahaluu might be questioned.

7. The key individuals involved in promoting the Kahaluu Flood Control Project need to be identified, so that additional information concerning the project that they might have can be made available.

Introduction to the Review Section

HESL's comments and questions focus on nine critical areas:

1. Structural Alternatives
2. Cost and Benefit Calculations
3. Alternative Concepts
4. Effect on Biota and Kaneohe Bay
5. Flood Plain Concepts
6. Appropriateness of SCS Aiding Urbanization
7. Funding Problems
8. Principal Supporters and Actors

1. Structural Alternatives

Structural solutions examined in the Work Plan and the Environmental Impact Statement were not exhaustive. For example, a feasible alternative might be a concrete lined "v" channel configuration big enough to handle normal runoff discharge supplemented by inclined grassed embankments that would act as a spill way for peak discharges. During non-flood or normal conditions, this grassed area could serve as a recreation site. This alternative has the advantages of less concrete, less sediment accumulation and hence lower maintenance costs, better aesthetics, less irretrievable land commitment. Its disadvantages are the danger that discharge velocities might be too fast during a storm and cause up-rooting of grass on the embankments.

SCS determined that building dikes along the stream banks would reduce the size of the floodplain but would be an unsatisfactory alternative because problems of channel erosion and sedimentation in the bay would remain unsolved. However, the effects of diking the channel on erosion of channel banks are uncertain. Furthermore, channel erosion is not now a major problem or source of sedimentation. Diking would not solve the problem of all sedimentation in the bay, but it also appears that the flood control project as it is now proposed will not solve the sedimentation problem. (See further comments on sedimentation below). The alternative of diking the channel deserves further study.

Buried channels will be subject to regular clogging. The maintenance costs given in the Work Plan and the Environmental Impact Statement (EIS) hold for an open trapezoidal or rectangular channel. Costs will increase greatly for a closed buried channel.

Apparently the two large floods in 1965 were important in creating the pressure for a flood control project. Records of flooding in Kahaluu date only from 1937. Records of flooding before modern times are sketchy. Although there is some written material about the old Hawaiian water systems and water rights, interestingly enough there is little mention of flooding. The emphasis was on catching water to irrigate taro patches rather than protecting against damage from runoff. For this purpose, the Hawaiians constructed a system of "auwai" ditches which connected to streams at higher elevations and diverted water to lowlands which were far from streams.

A preliminary mapping of the auwai ditches and flood plain lines for Kahaluu has been made by HESL. The ditch system can only be partly reconstructed from old tax maps. There are many places where they have been buried, converted to drainage ditches, or left off maps by State surveyors. However, the part that could be mapped adds up to 4.5 miles of ditches.

The auwai ditches themselves do not contribute significantly to flood prevention. Their storage capacity is minimal. Diked agricultural lands such as taro patches would provide more significant storage capacity, but few such areas remain in the watershed. Diking or furrowing agricultural or pasture lands would provide storage capacity but only for rainfall on the managed area for runoff from upland areas crossing the managed areas.

2. Cost and Benefit Calculation

Benefits from the Flood Control Project are estimated partially on the basis of the amount of damage that would be prevented if Kahaluu was completely developed according to the current City and County General Plan. That plan includes a large industrial area and a resort area, both which are in the flood plain. Since the County is involved in a General Plan Revision for Kahaluu, the size of the benefits can be expected to change, especially if either the industrial area or the resort were eliminated.

The project is assumed to have a life of 100 years. In addition, the interest-rate at which the use of funds is evaluated is 4 5/8%. Changes in either of these assumptions may have a great effect on the cost/benefit ratio.

Recreation activities in the proposed park are included in the benefits. An estimate of 95,000 annual visitor days by Oahu residents and 120,000 tourist visits per year is given. Some question might be raised of the ability of such a small park to handle the Oahu resident projected use and of the attractive power the park would have, due to many other competing recreation locations. The park may actually be only a neighborhood park, which possibly is a positive benefit for current residents of Kahaluu.

The nature of damage that could be expected to the various kinds of development in the flood plain was estimated statistically from data for three floods in Kahaluu in 1963 and 1965. No specification of the exact manner of estimation is made in either report. Normally three observations would not be considered adequate for producing very exact predictions of future damage.

Not indicated as a portion of the costs attributed to the project is the cost of relocating the 25 households affected by the construction. If these people require public housing, the cost could be as high as $60,000 per family.

An additional cost which is not considered is the cost of increased siltation of Kaneohe Bay due to the increased urbanization permitted by the flood control project. This urbanization will undoubtedly require considerable grading and site preparation with the attendant inevitable soil loss. Each cubic yard of soil lost would cost $0.75 to dredge out of Kaneohe Bay.

Finally, it is interesting to note that according to the SCS's estimates of benefits and costs for structural measures (as shown on page 59 of the Work Plan)

the average annual benefits due solely to flood damage reduction and secondary benefits is actually less than the annual cost of the project. The favorable cost benefit ratio can be seen as due primarily to the $144,810 worth of annual benefits due to recreation. This is also shown by the fact that the net annual benefit for the structural measures is only $129,940.

Recalculation of the benefit-cost comparison would seem to be indicated.

3. Alternative Concepts

Although the above comments indicate that the flood control project benefit-cost comparison may need recalculation, a more fundamental criticism of the flood control project evaluation might be raised. At several points in both the Work Plan and the EIS, the strong link between the flood control project and the urbanization of the region is stressed. The benefits used to justify the project are based on this urbanization, which might not occur without the project. As a result, it is difficult to see the value to decision makers of a narrow focus for comparing costs and benefits.

The real decision which must be evaluated in terms of benefits and costs by all concerned is whether the net benefit of Kahaluu's urbanization is greater than the net benefit of accommodating urban demands in some other area of Oahu. The costs of Kahaluu's urbanization cannot be considered to include only the eight million for the flood control project but also all the other supporting public expenditures for such things as sewage treatment, roads, schools, and parks. In addition to these more easily measured costs, account must be taken of costs more difficult to weight but still very real, such costs as providing new housing and employment for low income residents and farmers who would be forced out of Kahaluu by rising land values due to urbanization, the cost of social damage due to destruction of life style, and the ecological damage that would be done to Kaneohe Bay by the extensive grading involved in urbanization of the area.

Thus the crucial decision facing Kahaluu residents and the decision makers who will decide the fate of Kahaluu is not whether they want a flood control project or not, but what is the future of Kahaluu going to be? It is only after this question is answered that the appropriate flood control project can be chosen. Using the same argument, a General Plan amendment which was only concerned with the lagoon would seem to be equally narrow. Since the lagoon is an integral part of both a regional park and a flood control project which will drastically affect the future land uses in the area, some plan for all of Kahaluu would seem to be necessary before the desirability of the lagoon could be agreed upon.

One alternative that might be considered would be a flood prevention program designed to minimize the loss to existing flood plain uses without encouraging further urbanization. The main difference between flood prevention and flood control in this case is that flood prevention would minimize the periodic small floods which damage agricultural crops primarily. Large floods would still occur. Once these small floods overflow the natural stream banks, they flow overland for some distance at speeds sufficient to do serious damage to crops. Thus the major protection of such a program would be to agriculture.

Flood control assumes that a certain amount of water will reach a certain place at a certain time. These facts determine how wide and deep a channel must be built to accommodate the water collected at that point.

Flood prevention is more concerned with preventing runoff, slowing it down, and keeping it spread out through good conservation and land management practices. Although the Work Plan considers land treatment measures as part of the flood control project, the measures mentioned seem to be the usual "voluntary" conservation programs for private landowners and tree-planting programs by the State Division of Forestry in the State-owned areas of the watershed.

Studies have shown there is no substitute for vegetation for runoff control. Alternatives such as stream setbacks lined with trees, a tree-planted buffer zone running across the entire watershed, or a ditch improvement and maintenance system might be considered. The eight million dollars budgeted for the project would go a long way toward accomplishing land treatment measures including land acquisition that would work. The problem is that government does not control what a private landowner does with his land. If his land contributes heavily to runoff and downstream flooding, there is no legal responsibility. The communal maintenance of the old Hawaiian auwai system stands in sharp contrast to the existing social controls.

The concrete channels proposed by the watershed plan not only give protection against large storms such as occurred in May and February of 1965, but also give enough extra protection so that all the vacant urban district lands in the watershed could be developed.

Briefly summarized, the background of the current land use controls in Kahaluu is as follows. In 1968, the State Land Use Commission changed some 700 acres from agriculture to urban district. The land remained designated as agricultural on the City and County of Honolulu General Plan. The City Planning Department in their General Plan revision program may be moving to redesignate this new "urban" area as residential in order to permit development.

A comprehensive survey done in the Central Oahu Planning Study of vacant lands inside the State urban district on Oahu found that the Kahaluu lands put into the urban district in 1968 were not as "developable" as other available vacant lots on Oahu. The two major limitations on development were flooding hazard and lack of sewage treatment facilities. The flood control project would remove the first limitation completely.

An indication that the flood control project is not designed with the idea of preserving the existing agricultural-rural nature of Kahaluu is given by the SCS's estimate of the value of existing improvements and the potential value of improvements if Kahaluu is urbanized. It makes little sense to put in an eight million dollar project to protect the existing development in the flood plain of $6.7 million; such development would make sense if the estimated $64.6 million of potential urban development was in place.

Even if the question of the nature of total benefits and total costs were resolved, the question of the distribution of those benefits and costs would still remain. The SCS states in the EIS that social and economic conditions would

improve. The question of distribution is whose social and economic conditions? Although a complete discussion of this question is not to be found in either of the documents, it is instructive that two of the adverse environmental effects listed in the EIS suggest farmers and low-income residents will not be the primary beneficiaries of the project. On page 15 of the EIS, it is stated that:.

> ". . . The project will accelerate construction of new buildings in the now flood-prone urbanized land when the area is protected by the project. This will cause urbanization of Kahalu'u. . . . Land values and real estate taxes will increase, forcing some farmers and residents to move or change their way of life."

Elsewhere it is noted that few of the present residents of the flood plan own their homes. Among the alternatives that might be considered would be designing projects which had different distributions of costs and benefits. Once again the necessity of considering the nature of Kahaluu's urbanization in evaluating the flood control project is apparent. The same flood control project might lead to widely different results depending on policies taken with regard to controlling the impact of the urbanization it allowed.

4. Effect on Biota and Kaneohe Bay

Under favorable environmental effects listed in the EIS, it is stated that "the lagoon will provide a good brackish water habitat for marine life." This might be true under normal conditions; in times of flooding, however, the lagoon would be changed to a fresh-water environment with a disruptive effect on the salt water plant and animal life. Vegetation would be particularly affected by this change. Some reduction in the potential recreational appeal of the lagoon might occur as a consequence.

Channelization will reduce channel erosion. However, the major cause of siltation of Kaneohe Bay is not channel erosion but is soil loss from unprotected construction scars and landslides. Such areas are prevalent in Kahaluu. In the Kahaluu area, the SCS found about 280 acres of land exposed to rainfall in 1968. A recent HESL survey identified about the same amount of land exposed by grading or landslides.

On page 21 of the Work Plan, it is stated that clogging of natural stream channels with debris and sediment during storms is a major cause of bank overflow. It seems likely that if the channel is paved, this debris and sediment would be more easily transported to the bay. In fact, such deposits seem to have occurred at the mouths of other channelized streams on Oahu. In addition, as was noted above, soil loss from the watershed is likely to be accelerated by the increased urbanization permitted by the project. In any case, the lagoon's ability to control sedimentation and its effectiveness in both normal and flood conditions needs further investigation. Due to the velocity of the water and the size of the soil particles being transported, the lagoon will not be of sufficient size to settle out the bulk of the sedimentation.

5. Flood Plain Concepts

The flood plain that the SCS refers to in the two documents is the flood plain that would result if Kahaluu was fully urbanized. HESL has compared this flood plain with the one that resulted from the May 1965 flood, a flood which very

well may have been close to the size of the 100-year flood. The 1965 flood covered 250 acres while the flood that would occur if the area was fully developed according to the SCS estimates would cover 304 acres of private property. The SCS says that the flood control project would protect a total of 323 acres.

Not only does development increase the size of the 100-year flood plain (in this case, by approximately 50 acres), but it has an even more dramatic effect on the size of the more frequent small floods.

6. Appropriateness of the SCS Aiding Urbanization

The U.S. Department of Agriculture pamphlet describing multiple-purpose watershed projects under Public Law 566 gives the impression that the typical project authorized under the law is either for protecting ag lands or helping small rural towns improve their water supply. However, it is briefly noted in the pamphlet that "watershed projects occasionally include other nonagricultural water-management measures."

According to Helen Hopkins, Congressional opinion in 1970 seemed to be that the projects under the law should be oriented toward helping agriculture. She notes that "the House Agriculture Subcommittee on Conservation and Credit had not given favorable consideration to the Kahalu'u flood control plan because it is primarily non-agricultural."

7. Funding Problems

The current difficulties all Federal programs are incurring in getting executive approval of expenditures points out the need to consider the problems associated with partial or incomplete funding of the project. This topic is not addressed by the Work Plan or the EIS.

One of the major local expenditures associated with the project is the acquisition of land by the City and County of Honolulu. It is reasonable to ask how much the cost of land acquisition has risen in the four years since the estimates were made.

8. Principal Actors

A question HESL is not prepared to address but one which is probably of interest is who the people are who have played important roles in promoting the flood control project. Of particular intrest is the Windward Oahu Soil and Water Conservation District Board of Directors, the 26 Cooperators in the Kahaluu area, and the people who formed the Kahaluu Flood Control Committee.

KAHALUU FLOOD CONTROL PROJECT

Historical Summary

The Kahaluu area has suffered many floods in recent years, but the two large floods in 1965 really showed the need for some kind of flood control. After these disastrous floods, the Kahaluu Flood Control Committee was formed and asked for help through the Soil Conservation Service (SCS) under Public Law 566.

Late in 1965, the federal government approved the area for flood control planning. During the next two and one-half years, engineers studied the area and planned a flood control project.

Between June and December of 1968 the SCS and the Flood Control Committee agreed upon a project with concrete lined channels and a recreational lagoon and park. During 1969 and early 1970, the residents at Kahaluu community meetings, the City Council, the Governor, and the U. S. Department of Agriculture approved the project. Although a U. S. Senate committee approved the project, a U. S. House Committee considered the project too big and non-agricultural. In May 1970, the Fifth State Legislature appropriate $1,050,000 for the project.

In May 1971, at the suggestion of Hui Koolau and the Windward Soil and Water Conservation District (WSWCD), the Sixth State Legislature appropriated $1,000,000 to reduce the cost of the project to the federal government. In March of 1972, the U. S. House committee approved the project.

During early 1972, Hui Koolau, WSWCD, and the Mayor asked SCS to examine whether a more natural design were possible for the concrete channels. Discussion of this possibility is continuing.

T Watershed Work Plan

Agencies Involved: The local agencies sponsoring the project are the Windward Oahu Soil and Water Conservation District (WSWCD) and the City and County of Honolulu. The federal agency involved is the Soil Conservation Service (SCS) of the U. S. Department of Agriculture.

The Problem and the Objectives: The Work Plan cites the high flood hazard and the lack of recreational facilities as major problems in the area. The three objectives set forth by the Kahaluu Flood Control Committee are: 1) flood prevention, 2) treatment of eroded lands, and 3) enhancement of the social and economic development of the community.

Land Treatment and Structural Measures: The Work Plan calls both for WSWCD staff to work with interested landowners to treat areas of active sedimentation and also for building of flood control structures. The flood structures will protect against the 100 year flood, that is, a flood that has a 1% chance of occurring each year. This will prevent loss of life and encourage development of the floodplain.

The project will protect only the lower portion of the watershed from flooding. 11,850 feet of rectangular concrete channel will be built on Waihee, Kahaluu, and Ahuimanu Streams. The 28-acre lagoon along Kahekili and Kam Hwys. will be grass lined and surrounded by a 22-acre park. The lagoon will have shallow banks and a deep channel dredged to the bay for boats. There will be two debris-catching basins at the mauka end of the concrete channels of Kahaluu and Waihee Streams. Four concrete bridges and culverts will be built where roads cross the concrete channels.

The Project Costs and Benefits: According to the Work Plan, the project will have a benefit-cost ratio of 1.3:1.0. This means that every $1.00 spent on the project will result in $1.30 worth of benefits to the community. The costs include the price of building and maintaining the flood control structures. The

benefits are the estimated yearly savings from damage due to floodwater, sediment, erosion as well as secondary benefits. For estimating benefits from the project, the Work Plan assumes that Kahaluu will be fully developed under the existing zoning. This means that there are considerable benefits estimated for savings from flood damage to non-agricultural land uses. These include future resort, industrial, commercial, residential, and public utility developments.

Phasing of the Project: Construction is planned in four phases. These are: 1) the lagoon, 2) the Waihee Stream channels, 3) the Ahuimanu Stream channel, and 4) Kahaluu Stream channel. As construction begins on one phase, the design of the next phase will be finalized.

The Draft Environmental Statement

The SCS has prepared a Draft Environmental Statement for public review and eventual submittal to the Council on Environmental Quality Control. The following summary of favorable and unfavorable environmental effects and alternatives considered to the project is taken from the statement.

"Favorable Environmental Effects: The project will reduce erosion on cultivated and other land; protect 292 acres of agricultural and urban lands from flooding; reduce annual flood waters, erosion and sedimentation damages by $314,680; improve the quality of water that enters Kaneohe Bay; reduce degradation of marine habitat in Kaneohe Bay; create a lagoon for recreation and a marine habitat; reduce risk to life; and improve social and economic conditions.

Adverse Environmental Effects: The project will replace 11,850 lineal feet of natural stream with improved channels, remove 34 acres from grass production, require the relocation of 14 families, 25 elderly bachelors and one business; create some water, air and noise pollution during construction; remove some trees and other vegetation; create high velocity flow of water in channels during floods; eliminate aquatic habitat in portions of the streams; and will cause an increase in land values and real-estate taxes.

Alternatives Considered: Alternatives considered were: restricting further development in the watershed and making flood insurance available to the inhabitants of the floodplain; permanent evacuation of the floodplain and providing structural measures to prevent flood damage. Structural measures considered were enlarged but unlined channels, flood-water retarding structures, lined channels and debris basins. Other elements of the plan include land treatment practices to reduce erosion and run-off from the upper watershed."

Status of Funding and Release of Funds

The federal government has approved $3,740,000 for the project. The SCS must request release of the federal funds for each phase of the project. SCS is now optimistic that they will request funds in May or June of 1973 for release late in the coming fiscal year (February or March 1974). The funds would be for construction of the lagoon, which is the first phase of the project.

The State has appropriated $2,050,000 for the project. These monies are now available and can be released at the request of the City and with the approval of the Governor.

The City's capital improvement budget requests $1,085,000 in city funds for the project over the next six years. The budget that is now before the City Council for approval requests $20,000 of that sum for planning and engineering during 1973-74. It also proposes spending $950,000 of the state funds for land acquisition. The Council will examine the flood control project against as it considers this year's funding.

Status of Project

Two things must occur before federal funds can be released for any phase of the project. The particular phase of the project must be incorporated into the county general plan, and the needed land must be acquired by the City Dept. of Public Works. As land is acquired, residents must be relocated by the Honolulu Redevelopment Agency.

The City Planning Department has, for some time, proposed amending the General Plan for Kahaluu. Several Kahaluu issues were to be examined during this review including the flood control project and the floodplain.

It now appears that the Planning Dept. is giving a higher priority to amending the general plan to include at least the lagoon area so that work can proceed on the first phase of the flood control project. It is not certain whether this early

review will include the remainder of Kahaluu.

The design of the proposed rectangular channels has been under discussion and restudy since 1968. At the request of the Kahaluu Flood Control Committee, SCS and the City have been studying the possibility of changing the design of the structures. The purpose has been to improve the environmental impact of the structures without sacrificing their ability to control flooding. Primarily, the Flood Control Committee would like some of the concrete channels to be buried beneath the ground and have public parks extending along their length. The City Public Works Dept. has tentatively accepted the proposal to bury the channel for Waihee Stream.

More recently, the Flood Control Committee proposed burying the Kahaluu channel while maintaining the natural streambed of Kahaluu Stream. The park would include both the streambed and the buried channel, which would carry only flood waters. This proposal is being studied by the Public Works Dept. Public Works has expressed concern over the additional cost that would be involved and whether the proposal has the support of residents in the area. SCS expects that final design of the Kahaluu channel will be determined after the lagoon phase is underway.

The City Parks Dept. has tailored a master plan for parks in Kahaluu that would meet the Flood Control Committee's request for parks along the streams and facilitate amending the General Plan to include the flood control project. The Parks master plan shows wide park strips along the major streams including the areas proposed for channelization and the unprotected floodplain areas mauka of the channeled streams. The Parks plan will be considered in the general plan amendment. According to the Public Works Dept., the park strips would be wide enough to accommodate the flood control structures with any changes that are made in their design or location.